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BIOLOGICAL EVALUATION

BARK BEETLE INFESTATION FOR PROPOSED GRIMES CREEK AND SIDE HOLLOW TIMBER SALES

1979

Forest Insect and Disease Management
State and Private Forestry
USDA - Forest Service
Boise, Idaho

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INTRODUCTION [1/]

Tree mortality from bark beetles has reached high levels in virgin stands of ponderosa pine on the Escalante Ranger District, Dixie National Forest. Aerial observers detected beetle activity beginning in the mid 1960's. In 1978 numerous spots of beetle activity were observed, indicating a building infestation. Currently these spots have intensified numbering some 13,000 scattered dead trees (Fig. 1). A complex of bark beetles is responsible for first attacking high-risk mature-overmature ponderosa pines and later causing mortality in the smaller and sapling size classes.

Trees were drought stressed by conditions averaging 4.19 inches of precipitation below normal from 1975 through 1977. These conditions probably contributed to the present infestation by predisposing host trees to beetle attack.

This report presents data and recommendations for the proposed Side Hollow and Grimes Creek timber sale areas which are affected by the beetle infestation.

GENERAL INFORMATION

INSECTS: Mountain pine beetle, Dendroctonus ponderosae Hopk.
Roundheaded pine beetle, D. adjunctus Blandford.
Western pine beetle, D. brevicomis LeConte.

HOST TREE: Ponderosa pine, Pinus ponderosa Laws.

LOCATION: Escalante Ranger District, Dixie National Forest, Utah.

TYPE OF DAMAGE: Killing of sawtimber, pole, and sapling size trees beginning with large old growth.

EXTENT OF DAMAGE: Throughout approximately 31,000 acres of ponderosa pine.

CAUSAL AGENT BIOLOGY:

Dendroctonus spp. - Adult beetles attack trees by boring through the bark to the cambium. These attacks frequently introduce a blue stain fungus (Ceratocystis spp.) which hastens the death of the host tree. Adults tunnel the inner bark constructing egg galleries.

1/ Conducted by R. W. Thier, Entomologist, FI&DM and Ron Beveridge, Biological Technician, Boise NF.

The females deposit eggs in niches on both sides of the egg galleries and fill the galleries with partially digested wood particles, known as frass.

Following egg hatch, the larvae, or grubs, feed on the inner bark constructing individual tunnels away from the egg gallery. When fully developed, the grubs pupate at the end of the larval mine in the inner or outer bark. From this stage the grub pupates then transforms to an adult beetle. When fully transformed these brood adults emerge, fly to new host trees, initiate new attacks and mate to begin the next generation.

The following table indicates some of the more important specific differences in bark beetle biology.

Table 1. Biological Information - Dendroctonus spp.

Species	Attack Period	# Broods/ Year	Egg Gallery Pattern
Mountain pine beetle	June-September	1	Parallels bole
Western pine beetle	May-June	1-3	Meanders or winding
Roundheaded pine beetle	September-November	1	Parallels bole

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These beetles prefer to attack stressed trees. Stress is due to various causes but in this case overmature trees with stagnated growth were further stressed by droughty conditions.

Ips spp. - Ips may make a series of attacks during spring and summer months because they produce several broods. This reproductive capacity increases the damage potential of these insects.

In spring the life cycle begins with the overwintered stage which is predominantly mature adults. Adults are found under the bark of infested trees and slash. Overwintered adults emerge and initiate attacks in April; attacks then occur constantly, due to overlapping generations throughout the warm season.

Since Ips are polygamous, several egg galleries radiate from a central nuptial chamber initiated by the male. Unlike Dendroctonus spp. these galleries are kept free of frass. The biology and habits of the immature life stages are similar to other bark beetles. These beetles prefer to attack slash and weakened trees. High numbers of beetles often build up in slash before attacking green trees.

METHODS

From October 31 through November 7, 1979, 20 permanent one-acre strip plots (1 chain x 10 chains) were established in each timber sale area (Figs. 2, 3). These areas were identified using information from the 1979 aerial detection survey and forest timber sale plans.

In each plot the total number of successfully attacked trees was recorded by DBH and attacking beetle species. The year of attack was also determined.

At the end of each plot, a variable plot (BAF-10) was established to obtain green tree data.

A smaller sample cruise was run east of the Cowpuncher Guard Station as a basis for the probable future trend of the beetle population in Grimes Creek and Side Hollow timber sale areas.

RESULTS

Infestation intensity by year is shown in Table 2. The Grimes Creek area has sustained more mortality than the Side Hollow unit. In both areas the infestation began in sawtimber size trees and remains predominantly in this category.

When compared to green tree data, approximately 14 percent of the ponderosa pine basal area (7 percent of trees) was killed in the Grimes Creek area with most killed over the past three years. Similarly, in Side Hollow, 5 percent of the ponderosa pine basal area (1 percent of trees) has been killed. Mortality examined during this survey resulted from attack by a complex of bark beetles. Two bark beetles, the mountain pine beetle and roundheaded pine beetle, were associated with most of the dead pines. Some pines were attacked by the western pine beetle and pine engraver beetle. Jointly, these beetles attack host trees from 6" to 42" DBH and roundheaded pine beetle 4-5" DBH.

DISCUSSION

Affected Environment - Both Grimes Creek and Side Hollow are predominantly virgin ponderosa pine stands with an average B/A of 61 $Ft.^2$/Acre. Much of this basal area is concentrated in large, overmature, dominant sawtimber size trees, with scattered regeneration. These overstory trees often have rounded tops and have essentially completed height and radial growth. Bark color tends toward orange and yellow with rather large bark plates between fissures. Ponderosa with these characteristics rate as high risk to beetle attack (Keen 1954).

RESULTS OF THE 1979 BARK BEETLE SURVEY

Escalante Ranger District, Dixie National Forest

Table 2.

AREA	YEAR	# PONDEROSA PINE KILLED			TOTAL	Killed Ponderosa Pine/Acre	P. Pine Basal Area (ft^2) Killed	# GREEN PONDEROSA PINE/ACRE		TOTAL	Live Ponderosa Pine Basal Area (ft^2/Acre)	% Ponderosa Pine Killed	% Total P. Pine Basal Area Killed
		Sapling	Poles	Sawtimber				Poles	Sawtimber				
Grimes Creek	1979	0	9	19	28	1.40	1.86	35.83	30.02	65.85	52.5	2.13	-
	1978	0	12	21	33	1.65	1.67	-	-	-	-	2.51	-
	1977	0	3	29	32	1.60	4.06	-	-	-	-	2.43	-
	TOTAL	0	24	69	93	4.65	7.59	-	-	-	-	7.06	14
Side Hollow	1979	0	0	11	11	0.55	0.95	19.67	36.86	56.53	70.0	.97	-
	1978	0	1	3	4	0.20	0.40	-	-	-	-	.35	-
	1977	0	1	14	15	0.75	2.24	-	-	-	-	1.33	-
	TOTAL	0	2	28	30	1.50	3.59	-	-	-	-	2.65	5
Cow-puncher	1979	48	94	57	199	49.75	18.86	-	-	-	62.0	-	-
	1978	3	44	58	105	26.25	27.88	-	-	-	-	-	-
	1977	1	0	15	16	4.00	9.39	-	-	-	-	-	-
	TOTAL	52	138	130	320	80.00	56.13	-	-	-	-	-	-

Based on aerial sketch maps (Fig. 1) the bark beetle infestation has intensified on the Escalante Ranger District and, in general, has moved to the east from the vicinity of Griffin Point and Cowpuncher Guard Station. In these epicenters of beetle activity, the following sequence has probably occurred in the last 3-4 years. Beetles first killed the old growth high-risk trees. Secondly, after building to high population levels in the larger trees, pole-size trees fell prey to the beetles. Lastly, trees in the sapling size class were killed. This trend can be seen for the Cowpuncher area in Table 2.

Under current management of the Grimes Creek and Side Hollow units, a similar sequence of events will occur probably over the next 3-4 years. This conclusion is supported by Amman (file 4500, letter dated September 21, 1979, to the Escalante Ranger District).

Alternatives to deal with this infestation follow:

Silvicultural Approaches:

1. Maintain Present Management - Under present management the beetle infestation will continue to intensify and spread throughout the sapling, pole and sawtimber pine on the District and perhaps to other adjacent areas.

The bark beetles are thinning large decadent trees from the virgin stands which reduces green merchantable volume and promotes more vigorous growth of the regeneration. Also, sawtimber values are reduced to salvage values.

Increased fire hazard is also a result of this alternative. Beetle caused tree mortality produces fuels of all size classes. Increased fire surveillance may be necessary as a result of the infestation.

Present management of the outbreak will cause several environmental changes. The infestation will convert the stand to very young ponderosa pine and leave many snags as wildlife trees. Perhaps there will be shifts in vegetative species composition but this would only occur in small localized areas.

2. Salvage Logging - Salvage logging would do little to stop the beetle infestation since trees would generally already be abandoned by the bark beetles. The infestation would continue to intensify and spread through larger high-risk pines and then continue into the smaller size classes. This alternative would be based on timber salvage values. Other results of this alternative are similar to number 1 above.

3. Harvest - Both high-risk green or infested merchantable-sized trees would be removed. Removal of mature-overmature high-risk green trees will help prevent extensive mortality by bark beetles.

Thinning stands to a low density and allowing them to grow back to optimum density before the next thinning or harvest at or below the recommended rotation age under management (ca. 100-140 years.) will help promote vigorous tree growth and best prevent outbreaks. Removal of high-risk trees through logging would: (1) minimize mortality from bark beetles and halt spread of the infestation; (2) maximize timber values and (3) permit vigorous growth of regeneration.

Logging in these areas could affect other resource areas such as soil and watershed, range, recreation and wildlife.

Slash produced by logging can trigger damage by pine engraver beetles.

Damage by Ips can be prevented or minimized by:

1) utilizing material to a 4-inch top

2) timing management activities to permit slash to dry. It is best to cut trees in mid to late summer and scattering slash to promote drying.

If winter or spring slash is created, be prepared to provide a continuous supply of green slash in June through September to keep the Ips in slash until rapid drying can be obtained during hot summer days.

Chemical Approaches:

1. Protective Spray - High value uninfested trees can be treated with an EPA approved protective spray. This treatment would protect trees from successful beetle attack and may be desireable around developed sites. Recreation and timber values would be maintained at an estimated treatment cost of $10/tree. Protective sprays have given two years protection of lodgepole pine on the Targhee National Forest.

Environmentally, this action would be safe if conducted in the prescribed manner. Non-target spraying would not occur since the insecticide is applied directly to the bark of the host tree.

2. Direct Suppression - This would involve the ground treatment of individual infested trees with an EPA registered material. Although the approach would effectively reduce the beetle population within the treated trees, in itself, spraying would not end the beetle infestation. High risk trees provide the ideal habitat for bark beetles and these would still be available.

Since tree mortality would persist, the alternative would be based on timber salvage values. Estimated treatment costs would be $10/tree.

This treatment, like a protective spray, is environmentally safe if used as directed. The insecticide is applied directly to the bark of the beetle infested tree.

Integrated Approach - This alternative allows for the application of all the above alternatives depending on the local situation, minimizing detrimental environmental impacts, and maximizing economic returns.

Silvicultural alternatives 1 and 2, although doing little to halt the beetle infestation, may be the best course of action if in inoperable areas or in areas already heavily impacted by beetles.

RECOMMENDATIONS

Apply integrated approach where economic and environmental conditions permit using the following guidelines:

1) Bring stands under management to reduce high risk overstory and thin remaining stands to below optimum spacing. Apply pine engraver beetle preventive measures.

2) Salvage infested and abandoned ponderosa pine where economically feasible.

3) Consider salvage of infested material and/or chemical application to protect and/or suppress outbreaks in developed sites.

REFERENCES

KEEN, FP. 1954. Ponderosa pine tree characteristics indicative of high risk to pine beetle attacks. USDA-FS California Forest and Range Exp. Station (unpublished report).

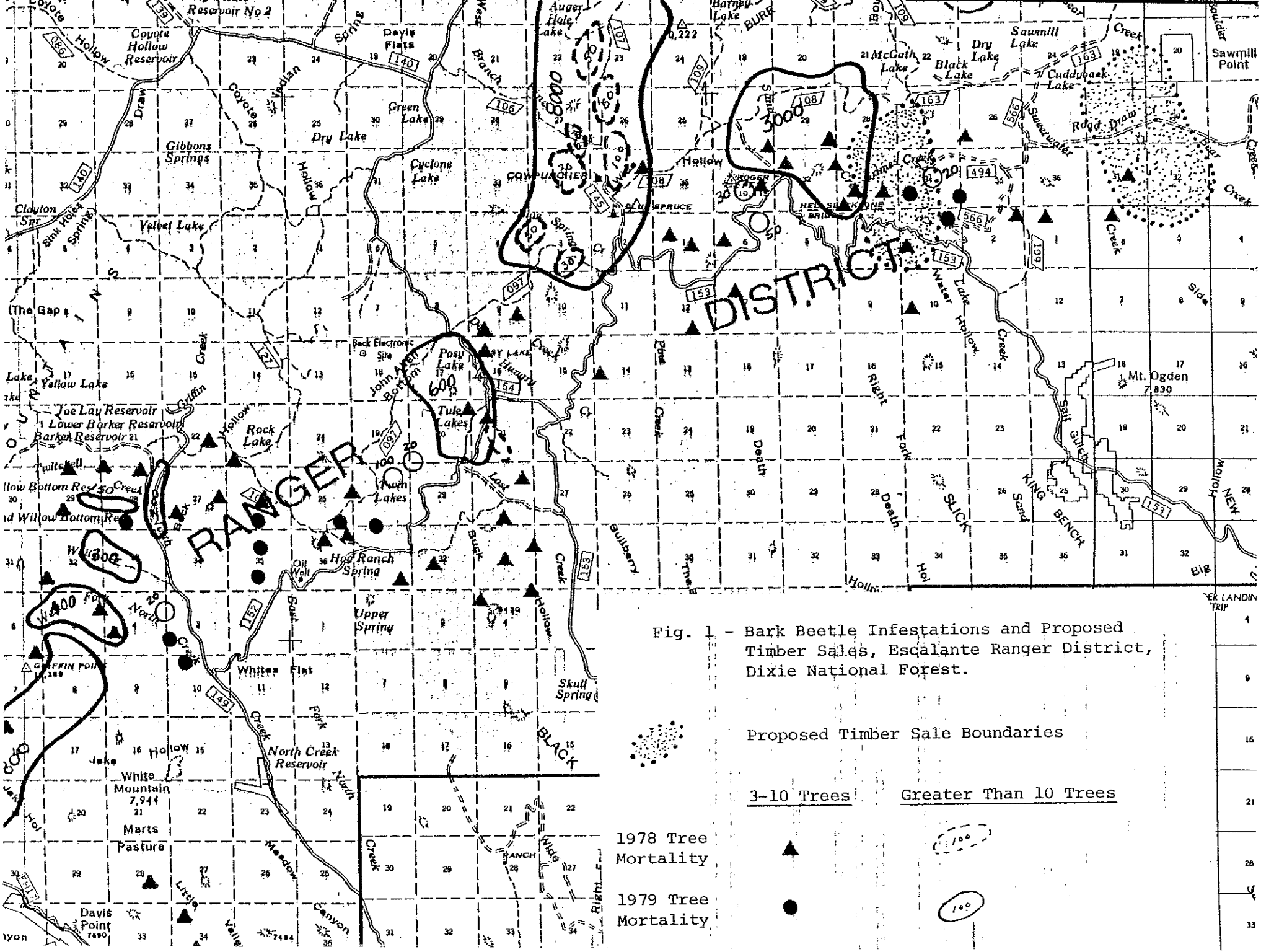
RANGER DISTRICT
Coyote Hollow Reservoir
Reservoir No 2
Davis Flats
Green Lake
Dry Lake
Gibbons Springs
Cyclone Lake
Velvet Lake
Clayton Spr
Sink Hole Spring
The Gap
Yellow Lake
Joe Lay Reservoir
Lower Barker Reservoir
Barker Reservoir
Mitchell
Willow Bottom Reservoir
Rock Lake
Tule Lakes
Twin Lakes
John Allen Bottom
Posy Lake
Back Electronic Site
Hog Ranch Spring
Upper Spring
Oil Well
Whites Flat
Skull Spring
North Creek Reservoir
White Mountain 7,944
Marts Pasture
Davis Point 7690
Griffin Point 7388
Auger Hole Lake
Barney Lake
McGath Lake
Black Lake
Dry Lake
Sawmill Lake
Cuddyback Lake
Sawmill Point
Mt. Ogden 7830
COW PUNCHER
BLUE SPRUCE
HELL'S BACKBONE
Water Canyon
Right Fork Death Hollow
Sand Gulch
KING BENCH
SLICK
Bullberry
Black Creek
North Fork Creek
Meadow Canyon
Little Valley
Wide Hollow
Big Hollow
NEW Hollow
Salt Gulch
Road Draw
Sweetwater
Boat Creek
Lake Hollow
Pine Creek
Death Hollow
Sink Hollow
Spring Creek
Indian Creek
Coyote Draw
Griffin Hollow
Rock Hollow
Jake Hollow
Skull Hollow
Sawmill Creek
Barney Lake Creek
Auger Hole Creek
Boulder Creek
Slide Creek
Humpy Creek
Water Hollow
Sawmill Creek
Boat Creek
Sweetwater Creek
Road Draw
Big Hollow
NEW Hollow
Skull Hollow
Jake Hollow
Griffin Hollow
Rock Hollow
Sink Hollow
Spring Creek
Indian Creek
Coyote Draw
Pine Creek
Death Hollow
Water Hollow
Lake Hollow
Sawmill Creek
Barney Lake Creek
Auger Hole Creek
Boulder Creek
Slide Creek
Humpy Creek
Water Canyon
Right Fork Death Hollow
Sand Gulch
KING BENCH
SLICK
Bullberry
Black Creek
North Fork Creek
Meadow Canyon
Little Valley
Wide Hollow
Big Hollow
NEW Hollow
Salt Gulch
Road Draw
Sweetwater
Boat Creek
Lake Hollow
Pine Creek
Death Hollow
Sink Hollow
Spring Creek
Indian Creek
Coyote Draw
Griffin Hollow
Rock Hollow
Jake Hollow
Skull

Fig. 2 - Bark beetle trend plots in Side Hollow Timber Sale, Escalante RD, Dixie NF

Plot numbers 1-20.

Fig. 3 - Bark beetle trend plots in the Grimes Creek Timber Sale, Escalante RD, Dixie NF.
Plot numbers 1-20.